Claims

1. Nanoscale or mesoscopic particles consisting of an inorganic material, characterized in that the surface thereof is divided into two zones Z1 and Z2, the zone Z1 carries groups F1 and the zone Z2 carries groups F2 different from the groups F1, the zone Z1 being free of groups F2 and the zone Z2 being free of groups F1.

2. The particles as claimed in claim 1, characterized in that the area of each zone represents at least 5% of the total area of a particle.

3. The particles as claimed in claim 1, characterized in that the area of each zone represents at least 10% of the total area of a particle.

4. The particles as claimed in claim 1, characterized in that the inorganic material A is a mineral oxide or a metal.

5. The particles as claimed in claim 4, characterized in that the inorganic material is a mineral oxide chosen from silica, iron oxides, aluminosilicates, titanium dioxide and alumina.

6. The particles as claimed in claim 4, characterized in that the metal is chosen from metals that are stable in an aqueous medium.

7. The particles as claimed in claim 1, characterized in that the inorganic material A is silica.

8. A method for preparing the particles as claimed in claim 1, characterized in that it comprises the following steps:

1) masking a zone Z2 of the surface of the initial particles by fixing a polymer nodule thereto;

2) treating the masked particles obtained at the end of step 1) in order to modify the nonmasked surface zone Z1 of said particles;

3) removing the polymer nodule after modifying the zone Z1;

4) optionally, modifying the surface of the zone Z2 of the particles following the demasking process.

9. The method as claimed in claim 8, characterized in that the initial particles used in step 1) have the shape of a sphere, an ellipse, a disk, a block or a rod.

10. The method as claimed in claim 8, characterized in that the polymer used for masking the zone Z2 of the surface of the initial particles comprises recurrent units $-CH_2-CRR'-$, which may be identical or different, in which:

- R represents H or an alkyl group,
- R' represents H, an alkyl group, an aryl group, an alkylaryl group, an alkenylaryl group, a pyridyl group, a nitrile group, a group -COOR" or a group -OC(O)R" in which R" is H, an alkyl or an alkenyl.

11. The method as claimed in claim 10, characterized in that R, R' and/or R" represent, independently of one another, an alkyl group or an aryl group which carries a functional group.

12. The method as claimed in claim 10, characterized in that said polymer is crosslinked or noncrosslinked.

13. The method as claimed in claim 10, characterized in that said polymer is a polystyrene or a copolymer of styrene and of divinylbenzene which is particularly preferred as material for the polymer nodule.

14. The method as claimed in claim 8, characterized in that step 1) comprises the following steps:

1a) modifying the surface of the initial particles using a coupling agent C which comprises a function F_C which has an affinity for one or more precursors of the polymer B;

1b) bringing the modified initial particles obtained at the end of step 1a) into contact with the precursor(s) of the polymer B, in the presence of a free-radical initiator and of a surfactant in solution in a solvent, in proportions that allow the formation of one polymer nodule per initial particle.

15. The method as claimed in claim 14, characterized in that the coupling agent, hereinafter referred to as

macromonomer, is a macromolecule having a hydrophilic chain that ends with a polymerizable function F_C.

16. The method as claimed in claim 15, characterized in that the macromonomer is chosen from poly(ethylene oxide)s, hydroxycelluloses, poly(vinylpyrrolidone)s, poly(acrylic acid)s and poly(polyvinyl alcohol)s, said compounds carrying said function F_C.

17. The method as claimed in claim 14, characterized in that step 1a) is implemented by covalent grafting of a coupling agent carrying a function F_C which is copolymerizable with the precursor(s) of the polymer.

18. The method as claimed in claim 17, characterized in that the material constituting the initial particles is a mineral oxide, and the coupling agent fixed by covalent grafting is chosen from organometallic derivatives such as organosilanes corresponding to the formula $R^1_nSiX_{4-n}$ (n=1 to 3), in which X is a hydrolyzable group and R^1 is a radical comprising said functional group F_C.

19. The method as claimed in claim 14, characterized in that the initial particles are suspended at a pH close to neutrality such that they are surface-charged, in the presence of an amphiphilic compound consisting of a hydrophobic part that has a polymerizable group and of a polar head that carries a charge opposite to that of the surface.

20. The method as claimed in claim 19, characterized in that the amphiphilic compound is chosen from compounds derived from styrene sulfonates (having a negatively charged hydrophilic polar head) and quaternary alkylammoniums (having a positively charged polar head), the two types of compounds carrying a hydrophobic group that ends with a polymerizable function.

21. The method as claimed in claim 14, characterized in that step 1b) is carried out by bringing the modified particles obtained at the end of step 1a) into contact with one or more monomers that are precursors of the polymer, in the presence of a polymerization initiator, said monomer(s)

carrying functions F_B capable of reacting with the functions F_C.

22. The method as claimed in claim 14, in which the coupling agent used in step 1) is a macromonomer fixed to the initial particle by adsorption, characterized in that, in step 2), the macromonomer is removed from the zone Z1 by desorption, and then the particles are brought into contact with a compound capable of reacting with the hydroxyl functions which are at the surface of the zone Z1.

23. The method as claimed in claim 22, characterized in that said compound is a trialkoxysilane carrying a functional group $-CH_2-CH_2-CH_2X$ in which X is an amine, a thiol or a glycidoxy group, said group optionally allowing subsequent couplings with other molecules.

24. The method as claimed in claim 14, characterized in that the coupling agent carrying the function F_C is grafted via a covalent bond onto the initial inorganic particle, said function F_C being the function F1 that is to be fixed to the zone Z1.

25. The method as claimed in claim 14, characterized in that the coupling agent carrying the function F_C is grafted via a covalent bond onto the initial inorganic particle, and in that the functions F_C are converted to functions F1 by a chemical process.

26. The method as claimed in claim 14, characterized in that step 3) is carried out by centrifugation or by sonication.